Teachers Guide **Grade 7**

Water Matters!

Saving Your Water through Science

Southwest Florida
Water Management District

WATERMATTERS.ORG • 1-800-423-1476

Introduction

Welcome to the *"Water Matters!"* curriculum developed by the Southwest Florida Water Management District (SWFWMD). The SWFWMD manages the water resources for west-central Florida as directed by state law. It was established, in 1961, as a flood protection agency. Since then, its responsibilities have grown to include managing the water supply, protecting water quality and preserving natural systems that serve important water-related functions.

As a teacher, you have a very important role in preparing students to take on the responsibility of being stewards of the land and our water resources. By educating your students about the protection of Florida's water, you teach them to be responsible citizens actively involved in maintaining a clean and healthy environment.

This Teacher's Guide accompanies the seventh-grade module of the *"Water Matters!"* curriculum which is correlated to the Next Generation Sunshine State Standards. The Student Publication contains vocabulary words (*italicized* and **bolded**) with vocabulary activities and review questions after each section. The Teacher's Guide includes answers to student questions and additional content, activities and websites to explore.

We encourage teachers to use this guide electronically as there are hyperlinks available for easy access to other resources. In preparation for using the *"Water Matters!"* curriculum with your students, it will be helpful to read the entire Student Publication and Teacher's Guide and test or bookmark the hyperlinks in the Teacher's Guide. While using the curriculum —

- Read and discuss the material presented in the Student Publication with your students.
- Direct students to complete the vocabulary activities and questions at the end of each section of the Student Publication and then discuss the results with students.
- Implement the extension activities you select from the Teacher's Guide.

Optional:

Have students build a foundation by reading the sixth-grade module of the *"Water Matters!"* curriculum which includes the hydrologic cycle, weather and climate and extreme weather.

Please note:

Suggested extension activities with an asterisk after the name reference Project WET activities. Project WET, which stands for Water Education for Teachers, is a series of hands-on, investigative and easy-to-use activities for teaching students about water resources. To receive a Project WET guide, teachers must attend a six-hour training. If you don't have a Project WET guide, check with your colleagues or order a free sample of the guide by emailing *WaterEducation@WaterMatters.org*. To learn more about Project WET, visit *ProjectWET.org*.

A variety of other publications and electronic resources are available from the SWFWMD. Visit *WaterMatters.org/Education* to learn more. For questions or comments, email *WaterEducation@WaterMatters.org*.

Section One:
Watersheds, Surface Water and Groundwater

Key Ideas

- We all affect the health of a watershed.
- Many organizations are involved in restoring and protecting surface water, including wetlands.
- Groundwater supplies most of west-central Florida's drinking water.
- Watersheds, surface water and groundwater are all connected.

Standards

SC.6.E.6.2
Recognize that there are a variety of different landforms on Earth's surface such as coastlines, dunes, rivers, mountains, glaciers, deltas, and lakes and relate these landforms as they apply to Florida.

SC.6.E.7.2
Investigate and apply how the cycling of water between the atmosphere and hydrosphere has an effect on weather patterns and climate.

SC.7.E.6.6
Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water.

Objectives

- Describe how water moves across the landscape of a watershed.
- Describe how watersheds are connected to surface water bodies.
- Explain how groundwater is polluted through human actions.

Vocabulary

watershed	ridge lines	divides
open system	closed system	surface water
groundwater	wetlands	karst terrain
topography		

Bellringer

On a scrap piece of paper, have students answer the following question, "Water always flows _____." Briefly discuss the answer of "downhill."

Engage

Ask students the following question "What is a watershed?"

Refer to the vocabulary cards and activities in the Appendix.

Blue River*

Project WET Curriculum and Activity Guide 2.0 version, page 135 or the 2.0 Sampler, page 43.
In this activity, students participate in a whole body exercise to simulate the movement of water through a river and its watershed.

Mapping the World's Watersheds

In this National Geographic activity, students will explore how topography shapes a watershed.
education.nationalgeographic.com/education/activity/mapping-watersheds/?ar_a=1

Explore

Students should read Section One of the *"Water Matters!"* Student Publication.

Here are additional exploratory options for you to select from and further student knowledge about watersheds, surface water and groundwater:

Virtual Watershed Excursions

Students can take a virtual excursion of the watershed in which they live or neighboring watersheds by visiting *WaterMatters.org/Watersheds*. There are also coordinating teacher's guides with activity sheets to help students navigate through an excursion. This can be done as a class, as groups or individually if students have computer access.

Podcasts

Visit *WaterMatters.org/Podcasts* to view short videos about watersheds, groundwater and wetlands.

Color Me a Watershed*

Project WET Curriculum and Activity Guide 2009 version, page 223 or the 2.0 version, page 239.
Students will observe how development causes changes in land use and analyze how these changes can affect the runoff of water in a watershed.

Explain

By completing the questions after Section One, students will explain what they read and comprehended. Discuss out loud student answers and clear up any misconceptions students may have.

Florida Waters Manual

Visit *WaterMatters.org/Publications*, or click here for a direct link to the Florida Waters Manuel. As a class or individually, read all about watersheds, surface water and groundwater in pages 49–62 of Chapter 3.

Seeing Watersheds*

Project WET Curriculum and Activity Guide 2.0 version, page 187 or the 2.0 Sampler, page 27.
Using topographical maps, students will characterize the movement of water in a watershed to determine water flow.

River Talk*

Project WET Curriculum and Activity Guide 2.0 version, page 175.
Students will describe a watershed using analogies of common things.

National Groundwater Association Lesson Plans

View multiple lesson plans including an activity for students to make their own groundwater model at *NGWA.org/Fundamentals/Teachers/Pages/Lesson-Plans.aspx*.

Working with Topographic Maps

View many resources for working with topographical maps from the U.S. Geological Survey at *Education.USGS.gov/Lessons/MapResources.html*. The Boy Scouts also have a simple activity for understanding topographic maps at *scouterlife.com/2012/05/topographic-map-activity.html*.

Elaborate

Make Your Own Watershed Activity

In this hands-on activity, students will see how water flows downhill in a watershed picking up pollutants on its way. View the instructions at *WaterMatters.org/Activities*. For a more advanced version that includes creating a clay model and mapping the watershed, visit *Floridaswater.com/Education/LessonPlans/WatershedIsland.html*.

Wetland Soils in Living Color*

Project WET Curriculum and Activity Guide 2.0 version, page 217.
By using a color key, students will learn about the properties of wetland soils and classify soil types.

Get the Groundwater Picture*

Project WET Curriculum and Activity Guide 2.0 version, page 143.
Students learn about the basic principles of groundwater as they create their own geologic cross section.

Evaluate

Analyzing Perspectives

Students will write an editorial stating and explaining their perspective on a current water or land issue facing people in their community. Students need to first research online or in a newspaper for information on current issues. Tell students to think about the following questions — What is the issue and why does it exist? What people or organizations are involved? What is being done to address the issue? Is there anything standing in the way of a solution?

Make-a-mural*

Project WET Curriculum and Activity Guide 2.0 version, page 515 or the 2.0 Sampler, page 73.
Students will create a mural depicting various aspects of the watershed in which they live.

Section Two:
A World Beneath Your Feet

Key Ideas

- In areas of karst terrain, rainwater dissolves limestone and recharges the aquifer.
- Earth is in a constant cycle of change.
- Human behaviors impact the Earth.

Standards

SC.6.E.6.1
Describe and give examples of ways in which Earth's surface is built up and torn down by physical and chemical weathering, erosion, and deposition.

SC.6.E.6.2
Recognize that there are a variety of different landforms on Earth's surface such as coastlines, dunes, rivers, mountains, glaciers, deltas, and lakes and relate these landforms as they apply to Florida.

SC.7.E.6.2
Identify the patterns within the rock cycle and relate them to surface events (weathering and erosion) and sub-surface events (plate tectonics and mountain building).

SC.7.E.6.7
Recognize that heat flow and movement of material within Earth causes earthquakes and volcanic eruptions, and creates mountains and ocean basins.

SC.7.E.6.6
Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water.

Objectives

- Explain how the hydrologic cycle impacts Florida's karst terrain.
- Justify why we must all conserve and protect our water resources.
- Identify how human behaviors affect the Earth's resources and landforms.

Vocabulary

cave/cavern	spring	sinkhole
aquifer	weathering	mechanical weathering
chemical weathering	erosion	

Bellringer

Ask students to write down five examples of how they used water today. Share responses.

Engage

Karst Limestone

Show students a piece of or photo of limestone. Ask students how the holes got in the rock? Discuss chemical weathering and how the process occurs.

Explore

Students should read Section One of the *"Water Matters!"* Student Publication.

Here are additional exploratory options for you to select from and further student knowledge about aquifers, karst terrain and weathering and erosion:

Karst Sugar Cube Activity

This activity shows students how water moves through a porous material, sometimes dissolving the material. It can be done as a class, in small groups or individually. Basic directions have been provided, but you can also look through the many variations of this activity online.

Supplies: 24 sugar cubes or more, icing, blue food coloring, water, eyedropper, aluminum pan or tray

Directions:

1. Stack the sugar cubes on top of each other on the tray. If needed, use minimal icing to secure the layers. For more advanced students, add impermeable layers of clay (or another material) between some of the cubes.
2. Let the icing dry overnight.
3. Using the eyedropper, have a student put 20 drops of colored water anywhere on the sugar cubes.
4. Record observations on where the water moves and how the shapes of the cubes change.
5. Repeat steps three and four once a day for a week or until a hole in the cubes is made or the cubes collapse.
6. Discuss how this experiment replicated a karst terrain and limestone as it dissolves from acidic rainwater.

Waters Journey: Hidden Rivers of Florida

Show students this three-part video of underwater cave explorers venturing into Florida's aquifer system. There is also a curriculum guide and supplemental activities available along with an interactive journey of water animation. Visit *FloridaSprings.org/Education*.

Springs

Visit *WaterMatters.org/Springs* to learn more about springs in west-central Florida. Website includes a short video and dashboards with at-a-glance views of water quality and flows data for the five first-magnitude springs in the SWFWMD.

Karst Terrain

The Alafia River Virtual Watershed Excursion available at *WaterMatters.org/Watersheds* has a section on karst terrain.

Explain

By completing the questions after Section Two, students will explain what they read and comprehended. Discuss out loud student answers and clear up any misconceptions students may have.

Florida Waters Manual

Visit *WaterMatters.org/Publications*, or *click here* for a direct link to the Florida Waters Manuel. As a class or individually, read all about aquifers and sinkholes in pages 53–57 of Chapter 3.

Elaborate

Edible Aquifer

Students will learn about the layers of the aquifer through this fun and tasty activity! Basic directions have been provided, but you can also look through the many variations of this activity online.

Supplies: clear plastic cups, clear soda such as Sprite or Ginger Ale, chocolate ice cream, crushed ice, green sprinkles, mini-chocolate chips, straws and spoons

Directions:

1. Fill the cup halfway with ice. This represents the Floridan aquifer, the limestone layer.
2. Add clear soda. This represents the groundwater in the Floridan aquifer.
3. Add a big scoop of chocolate ice cream. This represents the clay confining layer, which can be up to 300 feet thick in some places.
4. Add a few spoonfuls of mini-chocolate chips. This represents the surficial aquifer layer, which is a shallow aquifer system usually characterized by sandy soils.
5. Add a little more soda. This represents the groundwater in the surficial layer.
6. Add green sprinkles. This represents vegetation on the ground such as grasses, shrubs and trees.
7. Add a straw. This represents a well that taps into the Floridan aquifer. Drink up!

National Groundwater Association Lesson Plans

View multiple lesson plans including "How Water Flows in an Aquifer," "Making an Aquifer Model" and more at *NGWA.org/Fundamentals/Teachers/Pages/Lesson-Plans.aspx*.

Springing into Action*

Project WET Curriculum and Activity Guide 2.0 version, page 203.

Students will actively simulate the process of water infiltrating down-gradient and flowing through different layers before naturally exiting the ground through a spring.

Evaluate

Use Section Two's vocabulary cards and some of the activities to evaluate students' understanding of the terms and concepts.

Section Three:
Pollution and Water Quality

Key Ideas

- How did this pollution get here?
- How do I know the water in my watershed is healthy?

Standards

SC.6.E.6.1
Describe and give examples of ways in which Earth's surface is built up and torn down by physical and chemical weathering, erosion, and deposition.

SC.6.E.6.2
Recognize that there are a variety of different landforms on Earth's surface such as coastlines, dunes, rivers, mountains, glaciers, deltas, and lakes and relate these landforms as they apply to Florida.

SC.7.E.6.6
Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water.

SC.7.L.17.3
Describe and investigate various limiting factors in the local ecosystem and their impact on native populations, including food, shelter, water, space, disease, parasitism, predation, and nesting sites.

SC.7.N.1.1
Define a problem from the seventh grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

SC.7.N.1.5
Describe the methods used in the pursuit of a scientific explanation as seen in different fields of science such as biology, geology, and physics.

Objectives

- Compare and contrast stormwater runoff to saltwater intrusion.
- Explain how human activity can be a detriment or a benefit to water quality.
- List and describe three ways water quality can be measured.

Vocabulary

point-source pollution	nonpoint-source pollution	stormwater runoff
organic pollution	nutrients	saltwater intrusion
temperature	dissolved oxygen	turbidity
pH scale	macroinvertebrate	

Bellringer

Ask students how do you know if water quality is good or bad?

Engage

Show students a bottle of potable water and a bottle filled with lake or pond water. Ask which one is healthy.

Explore

Students should read Section Three in the Student Publication.

Here are additional exploratory options for you to select from and further student knowledge about water pollution and the quality of water:

Measuring Water Quality Podcast

This video, less than five minutes in length, shows a scientist from the SWFWMD testing water on the Hillsborough River. Also available at *WaterMatters.org/Podcasts* is an 11-minute video called Florida Watersheds that also discusses water quality.

Testing the Waters

Through hands-on water testing, students will learn some of the parameters scientists test to determine the quality of water. Directions, including how to order a free water test kit from the SWFWMD and a student data sheet, are available at *WaterMatters.org/Activities*. You may also visit *WaterMatters.org/WaterMonitoring* to read more about the subject.

Water Quality? Ask the Bugs!*

Project WET Curriculum and Activity Guide 2.0 version, page 421 or the 2.0 Sampler, page 51.

Students conduct a simulated bioassessment of a stream by sampling aquatic macroinvertebrates. This activity also fits under Elaborate.

A-maze-ing Water*

Project WET Curriculum and Activity Guide 2009 version, page 219 or the 2.0 version, page 231.

Students guide a drop of water through a maze of "drainage pipes" to learn how activities in their homes and yards affect water quality.

Storm Water*

Project WET Curriculum and Activity Guide 2.0 version, page 395.

Students learn how water travels through a community and how water can be managed by using best management practices.

Explain

Students should complete the vocabulary cards and activities in the Appendix for Section Three.

Florida Waters Manual

Visit *WaterMatters.org/Publications*, or *click here* for a direct link to the Florida Waters Manuel. As a class or individually, read about water quality in pages 74–85 of Chapter 5.

Elaborate

Macroinvertebrate videos and lesson plans

For two different lesson plans about understanding water quality through the critters that live in the water, visit *Floridaswater.com/Education/Lessonplans/*.

Science Project Ideas on Surface Water Quality

This document from the Environmental Protection Agency shares ideas on choosing a science fair project (or class project) on surface water quality topics.

Visit *Water.Epa.Gov/Learn/Resources/Upload/2008_12_08_Learn_Science-Projects.pdf*.

Sum of the Parts*

Project WET Curriculum and Activity Guide 2009 version, page 267 or the 2.0 version, page 283.

Students will demonstrate how everyone contributes to the pollution of a river as the river flows through its watershed. Students will also recognize how pollution can be reduced through individual and group actions.

Poison Pump*

Project WET Curriculum and Activity Guide 2009 version, page 93 or the 2.0 version, page 107.

Students will solve a mystery to discover that water can also produce negative effects for people.

Macroinvertebrate Mayhem*

Project WET Curriculum and Activity Guide 2009 version, page 322 or the 2.0 version, page 343.

Students play a game of tag to simulate the effects of environmental stressors on macroinvertebrate populations.

Evaluate

Students will complete the Critical Thinking extended response question at the end of Section Three.

Student Publication Answer Key

The following answers are a guide for you to evaluate your students' answers, which will vary.

Section One: Watersheds, Surface Water and Groundwater

1. Explain where groundwater comes from and how it makes its way into the aquifer.

   Groundwater comes from rain that seeps into the ground. As rainwater moves through the ground, it finds its way through cracks and openings in the limestone and slowly makes its way to the aquifer.

2. Describe how groundwater and surface water bodies are connected. Do you think pollution and contaminants in one could affect the other?

   Groundwater and surface water bodies are connected in many ways such as through aquifer recharge and discharge and through springs and sinkholes. Pollution and contaminants can affect both groundwater and surface water. For instance, stormwater runoff can move pollutants into surface water bodies and contaminate rainwater before it percolates into the ground and eventually into the aquifer.

3. Using evidence from the text, explain why wetlands are a valuable natural resource.

   Wetlands are a valuable natural resource because they provide wildlife habitat for plant and animal species, improve water quality by filtering pollutants, aid in flood protection by collecting rainwater and help to slow down shoreline erosion.

Section Two: A World Beneath Your Feet

4. Describe the journey of a raindrop as it falls from the sky to the point it reaches the Floridan aquifer. Then describe several ways the raindrop can exit the aquifer.

   Rain falls from the sky and lands on the ground. Rainwater that makes its way into the ground, passes through sediments and layers of limestone and dolomite that make up the aquifers. Some students may include more details mentioning water travels around 100–200 feet beneath the surface throughout central Florida or discussing karst terrain. Water may exit the aquifer through a spring or sinkhole. It could also be pumped up by humans.

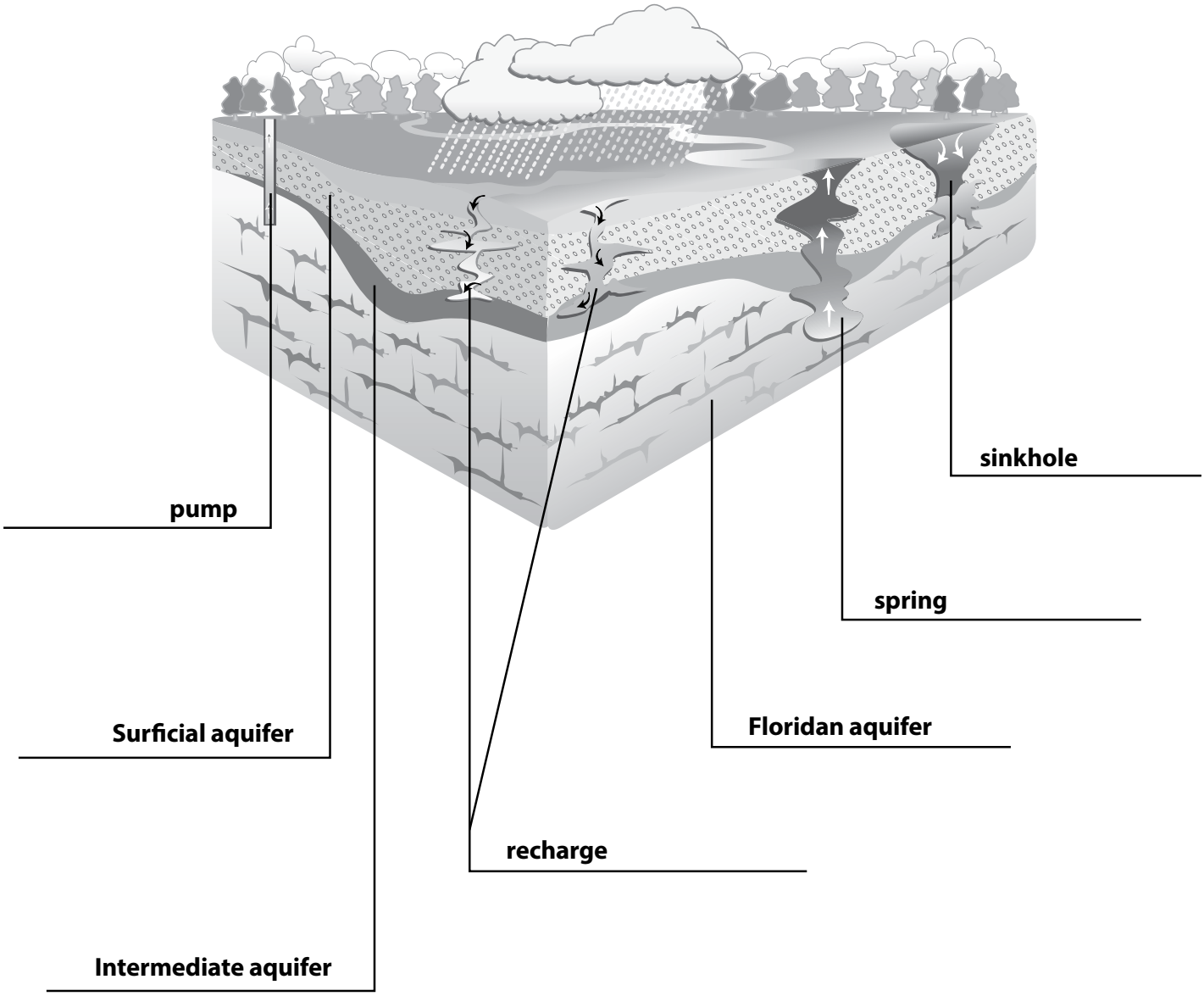
5. Explain why caverns, springs and sinkholes are common in areas with a karst terrain?

   Students should explain how acidic rainwater mixes with more CO2 in the soil and produces carbonic acid which dissolves the limestone. Over time, these tiny passages widen and widen, and some become large enough to form a cavern or sinkhole. The many passages in the rock also allow groundwater under pressure to exit the ground via a spring's natural opening in the bedrock.

6. Explain how water contributes to the different types of weathering?

   In mechanical weathering, waves smashing rocks against each other can wear rocks smooth and eventually turn them into sand. Temperature changes in mechanical weathering can also cause water to expand and contract. When water in the cracks of rocks freezes, it can cause the rock to split. During chemical weathering, some rocks will change in structure while others will completely dissolve in water. Water also affects chemical weathering through the water cycle and the climate of an area.

Florida's Aquifers Diagram



Section Three: Pollution and Water Quality

Critcal Thinking

Student responses will likely incorporate the topics of a watershed, point- and non-point source pollution, stormwater runoff and the various types of pollution. Ideally, students should include content from the previous sections such as how polluted groundwater exiting a spring would be carried along a spring-fed river before emptying into the bay or that surrounding wetlands may have been impaired and aren't able to filter as many pollutants from entering the bay. Feel free to encourage students to research this issue further if you want students to include more details that are specific to Tampa Bay.

Vocabulary Cards and Activities

Below are some ideas on using these vocabulary flash cards with your students. Before using, print the flash cards on cardstock, laminate them and cut them apart.

Vocabulary Activities

- Try to match the vocabulary word with the correct definition.
- Have students draw pictures of the vocabulary cards that match the definition.
- Students pick two cards from the deck, then make one sentence using both words.
- Place a large box on the floor. Students say each word or definition as they attempt to toss the card into the box.
- Lay all cards face down on a table and play "memory." Students will find the word and definition.
- Make a competition with your cards by forming two teams. Assign a scorekeeper to hold up cards and keep track as team members call out the right answers.
- Have your students design a new way to use the vocabulary flash cards.

Watershed	**an area of land that water flows across as it moves toward a common body of water, such as a stream, river, lake or coast**
Ridge lines or divides	**a line marking or following a ridgetop (a raised part or area on the surface of something; the place where two sloping surfaces meet) to cause to be separate, distinct, or apart from one another**
Topography	**the study of surface features of an area such as a mountain or valley**
Open system	**drainage basins that overflow into a larger body of water and eventually move out to sea**

Closed system	**water collects at a low point and only leaves the system through evaporation or by seeping into the ground**
Surface water	**water seen on the surface of the planet such as in a stream, river, lake, wetland or ocean**
Wetlands	**land that is wet all, or part, of the year and supports plants adapted to changes in water level**
Karst terrain	**landscape formed from bedrock dissolving slowly over time as acidic rainwater passes through the bedrock**

Groundwater	**water that has seeped into the ground and is held in soil and rock**
Aquifer	**a spongelike layer of underground limestone and rocks that can hold and release water**
Springs	**a place where groundwater that is under pressure discharges through a natural opening in the Earth's surface**
Nutrients	**naturally occurring chemical elements**

Sinkhole	**a collapsed underground space caused when bedrock erodes and dissolves from acidic water, a natural depression in the land surface**
Point-source pollution	**pollution coming from a single source; you can "point" at the source**
Non-point-source pollution	**pollution discharged over a wide area and not from one specific location**
Stormwater	**sheets of water that flow across roads, parking lots and land surfaces during a rainfall**

Organic waste	**a form of pollution that includes, human wastewater/sewage, animal wastes and food by-products**
Weathering	**process where rocks are broken down through exposure to wind, water, heat, and cold**
Mechanical weathering	**process of weathering that breaks apart rocks into particles**
Chemical weathering	**break down of rock by chemical mechanisms such as oxidation**

Heavy metals	**a metal with a specific gravity greater than about 5.0, especially one that is poisonous, such as lead or mercury**
Petroleum products	**products obtained from crude oil and natural gas processing**
Sediment	**the matter, or loose particles, that settle to the bottom of a liquid**
Saltwater intrusion	**the process of salt water entering groundwater reserves**

Temperature	**a measure of the warmth or coldness of an object or substance with reference to some standard value**
Dissolved oxygen	**the amount of oxygen dissolved in a body of water**
Turbidity	**lack of transparency or clarity of water, or how muddy it is**
pH scale	**a measure of acidity or alkalinity of water soluble substances**

Tolerant species	**species that are able to withstand or accept something that is harmful, such as poor water quality**
Sensitive or intolerant species	**species that are highly sensitive to pollution**
Pesticides and Herbicides	**a chemical used to kill "pests" like insects, people often spray them on lawns** **a chemical agent that kills plants or inhibits their growth, people often use them to kill weeds**